Claims

We claim:

1. An apparatus used in planarizing a front surface of a wafer, comprising:

a) an interferometer monitoring a front surface of a wafer;

b) a multizone carrier having a plurality of independently controllable pressure plenums, wherein the carrier is adapted for pressing the front surface of the wafer against a polishing surface; and

c) a control system in communication with the interferometer and the multizone carrier.

2. The apparatus of claim 1 wherein the interferometer comprises a light source positioned to direct a light signal towards a front surface of a wafer and a detector positioned to capture the light signal after reflecting off the front surface of the wafer.

3. The apparatus of claim 1 wherein the interferometer comprises a plurality of light sources each positioned to direct a light signal towards a location on a front surface of a wafer and a plurality of corresponding detectors each positioned to capture one of the light signals reflected off the front surface of the wafer.

4. The apparatus of claim 1 further comprising:

d) a platen adapted for supporting the polishing surface; and

e) a motion generator operably coupled to the platen.

5. The apparatus of claim 4 wherein the motion generator is operably coupled to the platen to rotate the platen.

6. The apparatus of claim 4 wherein the motion generator is operably coupled to the platen to orbit the platen.

7. An apparatus used in planarizing a front surface of a wafer, comprising:

a) a platen adapted for supporting a polishing surface;

b) a motion generator operably coupled to the platen;

c) a light source fixed to the platen to direct a light signal towards a front surface of a wafer;

d) a detector fixed to the platen to capture the light signal after reflecting off the front surface of the wafer;

e) a multizone carrier having a flexible membrane and a plurality of independently controllable pressure plenums for supporting the membrane, wherein the carrier is adapted for pressing the front surface of the wafer against the polishing surface; and

f) a control system in communication with the detector and the multizone carrier.

8. The apparatus of claim 7 wherein the light source and the detector function as an interferometer.

9. The apparatus of claim 8 wherein the motion generator is operably coupled to the platen to rotate the platen.

10. The apparatus of claim 8 wherein the motion generator is operably coupled to the platen to orbit the platen.

11. An apparatus used in planarizing a front surface of a wafer, comprising:

a) a platen for supporting a polishing surface;

b) a motion generator operably coupled to rotate the platen;

c) a light source positioned in the platen to direct a light signal towards a front surface of a wafer;

d) a detector positioned in the platen to capture the light signal after reflecting off the front surface of the wafer;

e) a multizone carrier having a plurality of independently controllable pressure plenums, wherein the carrier is adapted for pressing the front surface of the wafer against the polishing surface; and

f) a control system in communication with the light source, the detector and the multizone carrier.

12. The apparatus of claim 11 wherein the light source comprises a laser and the detector comprises an interferometer.

13. The apparatus of claim 12 further comprising a second laser and a second interferometer.

14. An apparatus used in planarizing a front surface of a wafer, comprising:

a) a temperature probe monitoring a front surface of a wafer;

b) a multizone carrier having a plurality of independently controllable pressure plenums, wherein the carrier is adapted for pressing the front surface of the wafer against a polishing surface; and

c) a control system in communication with the temperature probe and the multizone carrier.

15. An apparatus used in planarizing a front surface of a wafer, comprising:

a) an eddy current probe monitoring a front surface of a wafer;

b) a multizone carrier having a plurality of independently controllable pressure plenums, wherein the carrier is adapted for pressing the front surface of the wafer against a polishing surface; and

c) a control system in communication with the eddy current probe and the multizone carrier.

16. A method for planarizing a front surface of a wafer comprising the steps of:

a) continuously pressing a front surface of a wafer mounted in a multizone carrier against a working surface during a planarization process;

b) continuously generating relative motion between the front surface of the wafer and the working surface during the planarization process;

c) transmitting a light signal to the front surface of the wafer;

d) receiving the light signal after being reflected from the front surface of the wafer;

e) analyzing the light signal; and

f) adjusting the multizone carrier based on the analysis of the light signal.

17. The method of claim 16 wherein the light signal transmitted to the front surface of the wafer is a laser beam.

18. The method of claim 17 wherein the light signal received from the front surface of the wafer is an interference signal.

19. The method of claim 17 wherein the relative motion between the front surface of the wafer and the working surface comprises rotating the working surface.

20. The method of claim 18 further comprising the steps of:

g) repeating steps c) through f) until an endpoint condition has been detected.

21. A method for planarizing a front surface of a wafer comprising the steps of:

a) continuously pressing a front surface of a wafer mounted in a multizone carrier against a working surface during a planarization process;

b) continuously generating relative motion between the front surface of the wafer and the working surface during the planarization process;

c) transmitting a light signal to the front surface of the wafer;

d) receiving an interference signal from the front surface of the wafer;

e) calculating intensity measurements from the interference signal;

f) correlating intensity measurements with radial positions on the front surface of the wafer;

g) analyzing the intensity measurements and correlating radial positions; and

h) altering the planarization process based on the analysis.

22. The method of claim 21 wherein the relative motion between the front surface of the wafer and the working surface comprises rotating the working surface.

23. The method of claim 21 further comprising the steps of:

g) repeating steps c) through h) until an endpoint condition has been detected.

24. The method of claim 21 wherein the planarization process is altered by adjusting the pressure in one or more zones of a multizone carrier.

25. A method for planarizing a front surface of a wafer on a chemical mechanical polishing tool with a rotating working surface and a multizone carrier for holding the wafer and pressing it against the working surface, comprising the steps of:

a) polishing a first wafer by continuously pressing a front surface of the wafer against the rotating working surface using a first set of carrier zone pressures;

b) transmitting a plurality of sequential light signals to the front surface of the first wafer ;

c) receiving a plurality of reflected light signals from the front surface of the first wafer corresponding to the transmitted light signals;

d) correlating the reflected light signals with radial positions on the front surface of the first wafer;

e) determining a planarization condition of the front surface of the first wafer based on the reflected light signals and the radial positions thereof;

f) adjusting the multizone carrier to a second set of carrier zone pressures based on the planarization condition of the first wafer; and

g) polishing a second wafer using the second set of carrier zone pressures.

26. The method of claim 25, wherein the step of adjusting the carrier zone pressures comprises:

identifying a radial region of the first wafer that was overpolished relative to other regions of the wafer; and

adjusting the carrier zone pressures such that the lowest carrier pressure is substantially adjacent to the overpolished region of the first wafer.

27. The method of claim 25 wherein the light signals in the step of transmitting a plurality of light signals are laser light signal.

28. The method of claim 27 wherein an interferometer is used in step (c) for receiving the reflected light signals.